Docket No.: 050103-0574 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of	:	Customer Number: 49745
Xiaoding MA, et al.	:	Confirmation Number: 3136
Application No.: 10/776,223	:	Tech Center Art Unit: 1795
Filed: February 12, 2004	:	Examiner: McDonald, Rodney Glenn

For: GRANULAR MAGNETIC RECODING MEDIA WITH IMPROVED CORROSION RESISTANCE BY PRE-CARBON OVERCOAT ION ETCHING

TRANSMITTAL OF SUBSTITUTE APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Notification of Non-Compliant Appeal Brief dated May 15, 2009, submitted herewith is Appellant's Substitute Appeal Brief in support of the Notice of Appeal filed December 23, 2008. The Appeal Brief fee of $540.00 has already been charged to Deposit Account 500417.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due under 37 C.F.R. 1.17 and 41.20, and in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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SUBSTITUTE APPEAL BRIEF

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Commissioner for Patents
P.O. Box 1450
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Sir:

This Appeal Brief is submitted in support of the Notice of Appeal filed December 23, 2008, wherein Appellant appeals from the Primary Examiner's rejection of claims 1-3, 6-14, 26, 28-40 and 42.

Real Party In Interest

This application is assigned to SEAGATE TECHNOLOGY LLC by assignment recorded on February 12, 2004, at Reel 014984, Frame 0808.

Related Appeals and Interferences

Appellant is unaware of any related Appeal or Interference.

Status of Claims

1. Claims canceled: 4-5, 15-25, 27 and 41

2. Claims withdrawn from consideration, but not canceled: None

3. Claims pending: 1-3, 6-14, 26, 28-40 and 42

4. Claims allowed: None

5. Claims rejected: 1-3, 6-14, 26, 28-40 and 42

6. Claims on appeal: 1-3, 6-14, 26, 28-40 and 42

Status of Amendments

No Amendment has been filed subsequent to the issuance of the final Office Action dated June 24, 2008.

Summary of Claimed Subject Matter

The present application relates to methods for improving the corrosion resistance of thin film magnetic recording media and to magnetic recording media obtained thereby. See page 1, lines 2-3 of the specification. The present subject matter has particular utility in the manufacture of high areal recording density media, e.g., hard disks, utilizing granular-type magnetic recording layers. See page 1, lines 3-6 of the specification.

The present application addresses and solves problems, disadvantages, and drawbacks associated with the poor corrosion and environmental resistance of granular longitudinal and perpendicular magnetic recording media fabricated according to prior methodologies, and is based upon investigations of the present inventors which have determined that the underlying cause of the poor corrosion performance of such media is attributable, inter alia, to incomplete surface coverage of the protective overcoat layer (typically of a diamond-like carbon (DLC)

material) arising from increased nano-scale roughness of the granular magnetic recording layer relative to that of several other types magnetic recording layers, the presence of porous grain boundaries, and poor adhesion of the protective overcoat layer at the grain boundaries. See page 11, lines 2-12 of the specification.

The present application is further based upon recognition by the present inventors that the problems of poor corrosion and environmental resistance of granular magnetic recording layers can be mitigated, if not entirely eliminated, by performing a suitable treatment of the surface thereof prior to formation thereon of the protective overcoat layer. See page 11, lines 13-17 of the specification. More specifically, the inventors have determined that the corrosion resistance of such media may be significantly improved by etching the surface of granular magnetic recording layers with ions of an inert gas, e.g., Ar ions, for a sufficient interval to effect removal of a surface portion of the layers via sputter etching to effect at least one of the following: (i) a reduction of the nano-scale roughness and porosity of the layer; (ii) increased compositional homogeneity of the layer; (iii) increased microstructural homogeneity of the layer; (iv) preferential removal of at least one constituent, e.g., Co atoms, from the layer; and (v) increased grain boundary coverage by the subsequently deposited protective overcoat layer. See page 11, line 17 through page 12, line 2 of the specification.

One aspect of the present subject matter is represented by independent claim 1. Independent claim 1 describes a method of manufacturing granular magnetic recording media by sequential steps. The method includes providing a non-magnetic substrate including a surface. See page 12, lines 13-17 of the specification. A layer stack is formed on the substrate surface and the layer stack includes an outermost granular magnetic recording layer with an exposed nano-scale rough and porous surface. See page 12, lines 3-13 of the specification. The outermost

granular magnetic recording layer is formed by sputter deposition in an atmosphere with at least one reactive gas comprising oxygen, nitrogen, and/or carbon atoms. See page 12, lines 3-13 of the specification. The exposed nano-rough and porous surface of the granular magnetic recording layer is treated by way of sputter etching the exposed nano-rough and porous surface to provide at least one of: a reduction of the nano-scale roughness and porosity; increased compositional homogeneity; increased microstructural homogeneity; preferential removal of at least one element; and increased grain boundary coverage by a subsequently deposited protective overcoat layer which is formed on the treated surface of the granular magnetic recording layer. See page 12, line 18 through page 13, line 2.

Independent claim 26 describes a method of manufacturing granular magnetic recording media by sequential steps. The method includes providing a non-magnetic substrate including a surface. See page 12, lines 13-17 of the specification. A layer stack is formed on the substrate surface and the layer stack includes an outermost granular magnetic recording layer with an exposed nano-scale rough and porous surface. See page 12, lines 3-13 of the specification. The outermost granular magnetic recording layer is formed by sputter deposition in an atmosphere with at least one reactive gas comprising oxygen, nitrogen, and/or carbon atoms. See page 12, lines 3-13 of the specification. The nano-rough and porous surface of the granular magnetic recording layer is sputter etched. See page 12, lines 18-22.

Independent claim 32 describes a method of manufacturing granular magnetic recording media by sequential steps. The method includes providing a non-magnetic substrate including a surface. See page 12, lines 13-17 of the specification. A layer stack is formed on the substrate surface and the layer stack includes an outermost granular magnetic recording layer with an exposed nano-scale rough and porous surface. See page 12, lines 3-13 of the specification. The

outermost granular magnetic recording layer is formed by sputter deposition in an atmosphere with at least one reactive gas comprising oxygen, nitrogen, and/or carbon atoms. See page 12, lines 3-13 of the specification. The surface of the granular magnetic recording layer is sputter etched with ions of an inert gas. See page 12, lines 18-22. A protective overcoat layer is formed on the treated surface of the granular magnetic recording layer. See page 13, lines 1-2. The nano-scale roughness of the outermost granular magnetic recording layer is less than 2.0 Å. See FIG. 5.

Grounds of Rejection To Be Reviewed By Appeal

Claims 1, 2, 6-8, 11-14, 26, 28, 29, 31, 32, 35, 37-40, and 42 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 7,067,206 to Uwazumi et al. ("Uwazumi") in view of U.S. Patent No. 4,888,211 to Oka et al. ("Oka");

Claims 3, 30, and 36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Uwazumi in view of Oka, and further in view of U.S. Patent No. 6,432,563 to Zou et al. ("Zou"); and

Claims 9, 10, 33, and 34 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Uwazumi in view of Oka, and further in view of U.S. Patent No. 7,147,943 to Ono et al. ("Ono").

Argument

The rejection of claims 1, 2, 6-8, 11-14, 26, 28, 29, 31, 32, 35, 37-40, and 42 under 35 U.S.C. § 103(a) predicated upon Uwazumi and Oka

Examiner's Position

The Office Action asserts that Uwazumi teaches a method of manufacturing granular magnetic recording media. The Examiner avers that Uwazumi teaches providing a non-magnetic substrate including a substrate and forming a layer stack on the surface of the substrate, where the layer stack includes an outermost granular magnetic recording layer. The Examiner contends that Uwazumi teaches a protective overcoat layer on the magnetic layer.

The Office Action acknowledges that Uwazumi does not discuss a magnetic layer having a nano-scale rough and porous surface. The Office Action admits that Uwazumi does not discuss treating the exposed surface of the granular magnetic recording layer. The Office Action acknowledges that Uwazumi does not discuss etching the surface of the granular magnetic recording layer or sputter etching. The Office Action relies on Oka in an attempt to cure the admitted deficiencies of Uwazumi.

The Office Action asserts that Oka teaches treating the exposed nano-rough and porous surface of the granular recording layer to provide at least an increased microstructural homogeneity. The Examiner contends that treating can include sputter etching the surface of the magnetic layer with inert gas ions of Argon.

In the Response to Appellant's previously submitted arguments, the Examiner concludes that Oka would not teach away from sputtering on smaller scales. The Examiner concludes that while Oka teaches heating when depositing, the claims do not preclude heating during deposition.

Appellant's Position

Independent Claim 1

The secondary reference to Oka *teaches away* from the claimed sputter deposition of an outermost granular magnetic recording layer. Appellant submits that one of ordinary skill in this art would ***not*** have been motivated to sputter etch the outermost granular magnetic recording layer after forming this layer by sputter deposition, as required in claim 1. The Oka reference teaches, at col. 24, lines 48-53, the following:

> ***Examples 10 through 14 according to the present invention were advantageous*** over Comparative Example 12 ***according to the magnetron sputtering method in that the speed of drawn the substrate was very high and a speed ensuring practical industrial production could be obtained*** (*emphasis added*).

Oka concludes that sputter depositing a cobalt type alloy film is a conventional method (col. 1, lines 25-27 and 35-36). Oka states that the sputtering deposition method is **<u>not suitable</u>** for industrial production because the film-forming speed is low and the manufacturing cost is increased (col. 1, lines 27-30 and col. 2, lines 4-20). Oka teaches that the sputtering deposition method requires heating the substrate to a temperature of about 150° to 300°C during the formation of the film in order to improve the magnetic characteristics in the vertical direction of a Co-Cr alloy (col. 1, lines 35-39). Oka teaches other deposition techniques and adopts electron beam vacuum deposition **over** sputter deposition (col. 7, lines 27-39). Thus, Oka *teaches away* from the claimed sputter deposition of an outermost granular magnetic recording layer. Therefore, one of skill in this art would ***not*** have been motivated to sputter etch the outermost granular magnetic recording layer after forming this layer by sputter deposition.

The Examiner has not explained how Oka can ***teach away*** from sputter deposition for industrial production, yet somehow establishes a relationship between sputter depositing on "smaller

scales," let alone the claimed sputter deposition of the outermost granular magnetic recording layer. Oka clearly does not disclose sputter depositing the outermost granular magnetic recording layer.

In the Inventive Examples of Oka, the cobalt was melted and evaporated by ***electron beam evaporation*** and a magnetic layer was continuously formed on the film. Oka states in col. 22, lines 28-43:

> [t]he product obtained in ***Comparative Example 7 was of almost no practical use*** as a vertical magnetic recording medium for high-density recording.
>
> As shown in Table 4, ***in the products of Examples 7 through 9 according to the present invention, the diameter of the columnar structures was appropriate and the ratio of cobalt to cobalt monoxide in the columnar structures was appropriate***. Furthermore, since there were voids present among the columnar structures, ***the magnetic characteristics in the vertical direction were excellent and no cracks were present on the surface of the magnetic layer***. Accordingly, ***these products were very excellent as the vertical magnetic recording medium for high-density recording*** (*emphasis added*).

In Comparative Example 12, a vertical magnetic layer composed mainly of iron oxide was formed by magnetron sputtering. Oka states in col. 24, lines 62-68:

> In Comparative Examples, columnar structures were observed but they were very indefinite. The number of voids was very small, and the columnar structures were densely aggregated. Moreover, the height of the fine projections formed on the top ends of the columnar structures was small and the magnetic layer was relatively flat.

Oka explicitly teaches away from sputter deposition in the Comparative Examples. The Examiner has failed to point to any specific section in Oka that discloses sputter depositing, let alone lead one of ordinary skill in the art to modify the electron beam vacuum deposition method of Oka. Thus, Appellant submits that Oka cannot be properly relied upon to cure the admitted deficiencies of Uwazumi.

The only motivation for such a limitation is Appellant's own disclosure. Appellant's disclosure, however, is forbidden territory for the Examiner to obtain the requisite motivation for

combining the applied prior art. *Panduit Corp. v. Dennison Mfg. Co.*, 774 F.2d 1082, 227 USPQ 337 (Fed. Cir. 1985).

"Determination of obviousness cannot be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention." *ATD Corp. v. Lydall, Inc.*, 159 F.3d 534, 546, 48 USPQ2d 1321, 1329 (Fed. Cir. 1998). There must be a teaching or suggestion within the prior art, within the nature of the problem to be solved, or within the general knowledge of a person of ordinary skill in the field of the invention, to look to particular sources, to select particular elements, and to combine them as combined by the inventor. *See Ruiz v. A.B. Chance Co.*, 234 F.3d 654, 665, 57 USPQ2d 1161, 1167 (Fed. Cir. 2000); *ATD Corp*, 159 F.3d at 546, 48 USPQ2d at 1329; *Heidelberger Druckmaschinen AG v. Hantscho Commercial Prods., Inc.*, 21 F.3d 1068, 1072, 30 USPQ2d 1377, 1379 (Fed. Cir. 1994) ("When the patented invention is made by combining known components to achieve a new system, the prior art must provide a suggestion or motivation to make such a combination.").

As, Uwazumi and Oka do not disclose the same process of manufacturing granular magnetic recording media as disclosed by the present inventors, Uwazumi and Oka do not suggest each and every limitation of the method for manufacturing a granular magnetic recording media, as required by claim 1. Accordingly, Applicants respectfully request that the § 103 rejection be reversed.

Independent Claim 26

Oka *teaches away* from the claimed sputter deposition of an outermost granular magnetic recording layer. Appellant submits that one of ordinary skill in this art would ***not*** have been motivated to sputter etch the outermost granular magnetic recording layer after forming this layer by sputter deposition, as required in claim 26. The reference to Oka teaches at col. 24, lines 48-53 the following:

> ***Examples 10 through 14 according to the present invention were advantageous*** over Comparative Example 12 ***according to the magnetron sputtering method in that the speed of drawn the substrate was very high and a speed ensuring practical industrial production could be obtained*** (*emphasis added*).

Oka concludes that sputter depositing a cobalt type alloy film is a conventional method (col. 1, lines 25-27 and 35-36). Oka states that the sputtering deposition method is **not suitable** for industrial production because the film-forming speed is low and the manufacturing cost is increased (col. 1, lines 27-30 and col. 2, lines 4-20). Oka teaches that the sputtering deposition method requires heating the substrate to a temperature of about 150° to 300°C during the formation of the film in order to improve the magnetic characteristics in the vertical direction of a Co-Cr alloy (col. 1, lines 35-39). Oka teaches other deposition techniques and adopts electron beam vacuum deposition **over** sputter deposition (col. 7, lines 27-39). Thus, Oka *teaches away* from the claimed sputter deposition of an outermost granular magnetic recording layer. Therefore, one of skill in this art would ***not*** have been motivated to sputter etch the outermost granular magnetic recording layer after forming this layer by sputter deposition.

The Examiner has not explained how Oka can ***teach away*** from sputter deposition for industrial production, yet somehow establishes a relationship between sputter depositing on "smaller scales," let alone the claimed sputter deposition of the outermost granular magnetic recording layer. Oka clearly does not disclose sputter depositing the outermost granular magnetic recording layer.

In the Inventive Examples of Oka, the cobalt was melted and evaporated by ***electron beam evaporation*** and a magnetic layer was continuously formed on the film. Oka states in col. 22, lines 28-43:

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> As shown in Table 4, ***in the products of Examples 7 through 9 according to the present invention, the diameter of the columnar structures was appropriate and the ratio of cobalt to cobalt monoxide in the columnar***

> ***structures was appropriate***. Furthermore, since there were voids present among the columnar structures, ***the magnetic characteristics in the vertical direction were excellent and no cracks were present on the surface of the magnetic layer***. Accordingly, ***these products were very excellent as the vertical magnetic recording medium for high-density recording*** (*emphasis added*).

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The only motivation for such a limitation is Appellant's own disclosure. Appellant's disclosure, however, is forbidden territory for the Examiner to obtain the requisite motivation for combining the applied prior art. *Panduit Corp. v. Dennison Mfg. Co.*, 774 F.2d 1082, 227 USPQ 337 (Fed. Cir. 1985).

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the inventor. *See Ruiz v. A.B. Chance Co.*, 234 F.3d 654, 665, 57 USPQ2d 1161, 1167 (Fed. Cir. 2000); *ATD Corp*, 159 F.3d at 546, 48 USPQ2d at 1329; *Heidelberger Druckmaschinen AG v. Hantscho Commercial Prods., Inc.*, 21 F.3d 1068, 1072, 30 USPQ2d 1377, 1379 (Fed. Cir. 1994) ("When the patented invention is made by combining known components to achieve a new system, the prior art must provide a suggestion or motivation to make such a combination.").

As, Uwazumi and Oka do not disclose the same process of manufacturing granular magnetic recording media as disclosed by the present inventors, Uwazumi and Oka do not suggest each and every limitation of the method for manufacturing a granular magnetic recording media, as required by claim 26. Accordingly, Applicants respectfully request that the § 103 rejection be reversed.

Independent claim 32

Oka *teaches away* from the claimed sputter deposition of an outermost granular magnetic recording layer. Appellant submits that one of ordinary skill in this art would ***not*** have been motivated to sputter etch the outermost granular magnetic recording layer after forming this layer by sputter deposition, as required in claim 32. The Oka reference teaches at col. 24, lines 48-53 the following:

> ***Examples 10 through 14 according to the present invention were advantageous*** over Comparative Example 12 ***according to the magnetron sputtering method in that the speed of drawn the substrate was very high and a speed ensuring practical industrial production could be obtained*** (*emphasis added*).

Oka concludes that sputter depositing a cobalt type alloy film is a conventional method (col. 1, lines 25-27 and 35-36). Oka states that the sputtering deposition method is **<u>not suitable</u>** for industrial production because the film-forming speed is low and the manufacturing cost is increased (col. 1, lines 27-30 and col. 2, lines 4-20). Oka teaches that the sputtering deposition method requires heating the substrate to a temperature of about 150° to 300°C during the formation of the

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Oka explicitly teaches away from sputter deposition in the Comparative Examples. The Examiner has failed to point to any specific section in Oka that discloses sputter depositing, let alone lead one of ordinary skill in the art to modify the electron beam vacuum deposition method of Oka. Thus, Appellant submits that Oka cannot be properly relied upon to cure the admitted deficiencies of Uwazumi.

The only motivation for such a limitation is Appellant's own disclosure. Appellant's disclosure, however, is forbidden territory for the Examiner to obtain the requisite motivation for combining the applied prior art. *Panduit Corp. v. Dennison Mfg. Co.*, 774 F.2d 1082, 227 USPQ 337 (Fed. Cir. 1985).

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As, Uwazumi and Oka do not disclose the same process of manufacturing granular magnetic recording media as disclosed by the present inventors, Uwazumi and Oka do not suggest each and

every limitation of the method for manufacturing a granular magnetic recording media, as required by claim 32. The rejection is not legally viable for at least this reason.

Moreover, claim 32 further requires that the nano-scale roughness of the outermost granular magnetic recording layer is ***less than*** 2.0 Å. The Examiner contends that Uwazumi teaches nanoscale roughness because Uwazumi purportedly teaches the same deposition process and conditions as the claimed. The Examiner considers the sputter etching of Oka (that enhances the fineness of the projections on the substrate) to be the equivalent to reducing the roughness of the film. Appellants disagree with the Examiner's characterization of the reference.

To the extent that the Examiner is relying on official notice, Appellant notes that as explained in MPEP § 2144.03, official notice should only be taken of readily provable facts. Moreover, it is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record as the principal evidence upon which a rejection was based. *In re Zurko*, 258 F.3d 1379, 1385-6, 59 USPQ2d 1693, 1697 (Fed. Cir. 2001); *In re Ahlert*, 424 F.2d 1088, 1091-2, 165 USPQ 418, 420-1 (CCPA 1970).

The cited prior art does **not** recognize the advantage of obtaining the nano-scale roughness of the outermost granular magnetic recording layer to be ***less than*** 2.0 Å, as required by claim 32. The present inventors, however, have discovered that the decrease in surface nano-scale roughness of the outermost granular magnetic recording layer is an effect of sputter etching (*see, e.g.,* Figs. 3A, 3B, 4, 5, 6A, 6B, 7A, and 7B; and Paras. [0053], [0069], and [0072]). This unexpected result is neither suggested nor recognized by the cited references. The Examiner has not addressed the evidence of unexpected results. Further, the Examiner has not established that the cited prior art suggests an outermost granular magnetic recording layer having the specifically claimed range of nano-scale roughness ***less than*** 2.0 Å. To the extent that the Examiner is relying on personal knowledge, regarding the claimed limitation, an Examiner's

affidavit should be made of record to support the Examiner's conclusion. See 37 C.F.R. 1.104(d)(2). Neither Uwazumi nor Oka, individually or combined, discloses or infers, the nano-scale roughness of the outermost granular magnetic recording layer is less than 2.0 Å," as required by claim 32. Accordingly, the rejection of independent claim 32 is not legally viable for at least this additional reason. Reversal of the rejection is therefore solicited.

The rejection of dependent claims 3, 30, and 36 under 35 U.S.C. § 103(a) predicated upon Uwazumi in view of Oka, and further in view of Zou

The Office Action relies on Zou in an attempt to cure the admitted deficiencies of Uwazumi and Oka. The Office Action asserts that Zou teaches a granular magnetic layer that is longitudinal for use in a magnetic medium.

The combination of Uwazumi, Oka, and Zou does not teach or infer the claimed method because Zou does not cure the deficiencies of Uwazumi and Oka. Although not relied upon to do so, Zou is *silent* regarding etching, specifically sputter etching the outermost granular magnetic recording layer, as required by independent claims 1, 26, and 32.

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 1, 26 and 32 are patentable for the reasons set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance. Accordingly, Applicants respectfully request that the § 103 rejection of claims 3, 30 and 36 be reversed.

The rejection of dependent claims 9, 10, 33, and 34 under 35 U.S.C. § 103(a) predicated upon Uwazumi in view of Oka, and further in view of Ono

The Office Action acknowledges that Uwazumi and Oka do not discuss forming a diamond-like carbon (DLC) protective layer. The Office Action relies on Ono in an attempt to cure the admitted deficiencies of Uwazumi and Oka. The Office Action asserts that Ono teaches forming a DLC protecting layer for a magnetic layer by ion beam deposition.

The combination of Uwazumi, Oka, and Ono does not teach or infer the claimed method because Ono does not cure the deficiencies of Uwazumi and Oka. Although not relied upon to do so, Ono is *silent* regarding etching, specifically sputter etching the outermost granular magnetic recording layer, as required by independent claims 1 and 32. Dependent claims are allowable for at least for the same reasons as independent claims 1 and 32, and further distinguish the claimed method.

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 1 and 32 are patentable for the reasons set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance. Accordingly, Applicants respectfully request that the § 103 rejection of claims 9, 10, 33, and 34 be reversed.

Conclusion

For all of the foregoing reasons, Appellant respectfully submits that the grounds of rejection of the claims on appeal are in error and should be reversed.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due under 37 C.F.R. 1.17 and 41.20, and in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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Please recognize our Customer No. 49745 as our correspondence address.

CLAIMS APPENDIX

1. A method of manufacturing granular magnetic recording media, comprising sequential steps of:

(a) providing a non-magnetic substrate including a surface;

(b) forming a layer stack on said surface of said substrate, said layer stack including an outermost granular magnetic recording layer with an exposed nano-scale rough and porous surface, said outermost granular magnetic recording layer is formed by sputter deposition in an atmosphere with at least one reactive gas comprising oxygen, nitrogen, and/or carbon atoms;

(c) treating said exposed nano-rough and porous surface of said granular magnetic recording layer to provide at least one of:

(i) a reduction of said nano-scale roughness and porosity;

(ii) increased compositional homogeneity;

(iii) increased microstructural homogeneity;

(iv) preferential removal of at least one element; and

(v) increased grain boundary coverage by a subsequently deposited protective overcoat layer; and

(d) forming a protective overcoat layer on the treated surface of said granular magnetic recording layer,

wherein step (c) comprises sputter etching said surface.

2. The method according to claim 1, wherein:

step (b) comprises forming a layer stack including an outermost granular perpendicular magnetic recording layer.

3. The method according to claim 1, wherein:

step (b) comprises forming a layer stack including an outermost granular longitudinal magnetic recording layer.

6. The method according to claim 1, wherein:

step (c) comprises sputter etching said surface with ions of an inert gas.

7. The method according to claim 6, wherein:

step (c) comprises sputter etching said surface with Ar ions.

8. The method according to claim 1, wherein:

step (d) comprises forming a carbon (C)-containing protective overcoat layer.

9. The method according to claim 8, wherein:

step (d) comprises forming a diamond-like carbon (DLC) protective overcoat layer.

10. The method according to claim 9, wherein:

step (d) comprises forming said DLC protective overcoat layer by ion beam deposition (IBD).

11. The method according to claim 1, wherein:

step (a) comprises providing a non-magnetic substrate comprised of a non-magnetic material selected from the group consisting of: Al, NiP-plated Al, Al-Mg alloys, other Al-based

alloys, other non-magnetic metals, other non-magnetic alloys, glass, ceramics, polymers, glass-ceramics, and composites and/or laminates of the aforementioned materials.

12. The method according to claim 1, wherein:

step (b) comprises forming a layer stack including a granular Co-based alloy magnetic recording layer comprised of a CoPtX alloy, where X = at least one element or material selected from the group consisting of: Cr, Ta, B, Mo, V, Nb, W, Zr, Re, Ru, Cu, Ag, Hf, Ir, Y, O, Si, Ti, N, P, Ni, SiO_2, SiO, Si_3N_4, Al_2O_3, AlN, TiO, TiO_2, TiO_x, TiN, TiC, Ta_2O_5, NiO, and CoO, and wherein Co-containing magnetic grains are segregated by grain boundaries comprising at least one of oxides, nitrides, and carbides.

13. The method according to claim 1, further comprising a step of:

(e) forming a lubricant topcoat layer on said protective overcoat layer.

14. The method according to claim 13, wherein:

step (e) comprises forming a layer of a perfluoropolyether material.

26. A method of manufacturing granular magnetic recording media, comprising sequential steps of:

(a) providing a non-magnetic substrate including a surface;

(b) forming a layer stack on said surface of said substrate, said layer stack including an outermost granular magnetic recording layer with an exposed nano-scale rough and porous surface, said outermost granular magnetic recording layer is formed by sputter deposition in an atmosphere with at least one reactive gas comprising oxygen, nitrogen, and/or carbon atoms; and

(c) sputter etching said nano-rough and porous surface of said granular magnetic recording layer.

28. The method according to claim 26, wherein:

step (c) comprises sputter etching said surface with ions of an inert gas.

29. The method according to claim 26, wherein:

step (b) comprises forming a layer stack including an outermost granular perpendicular magnetic recording layer.

30. The method according to claim 26, wherein:

step (b) comprises forming a layer stack including an outermost granular longitudinal magnetic recording layer.

31. The method according to claim 26, wherein:

said granular magnetic recording layer comprises a CoPtX alloy, where X is at least one element or material selected from the group consisting of: Cr, Ta, B, Mo, V, Nb, W, Zr, Re, Ru, Cu, Ag, Hf, Ir, Y, O, Si, Ti, N, P, Ni, SiO_2, SiO, Si_3N_4, Al_2O_3, AlN, TiO, TiO_2, TiO_x, TiN, TiC, Ta_2O_5, NiO, and CoO, and wherein Co-containing magnetic grains are segregated by grain boundaries comprising at least one of oxides, nitrides, and carbides.

32. A method of manufacturing granular magnetic recording media, comprising sequential steps of:

(a) providing a non-magnetic substrate including a surface;

(b) forming a layer stack on said surface of said substrate, said layer stack including an outermost granular magnetic recording layer with an exposed nano-scale rough and porous surface, said outermost granular magnetic recording layer is formed by sputter deposition in an atmosphere with at least one reactive gas comprising oxygen, nitrogen, and/or carbon atoms;

(c) sputter etching said surface of said granular magnetic recording layer with ions of an inert gas; and

(d) forming a protective overcoat layer on the treated surface of said granular magnetic recording layer,

wherein the nano-scale roughness of the outermost granular magnetic recording layer is less than 2.0 Å.

33. The method according to claim 32, wherein:

step (d) comprises forming a diamond-like carbon (DLC) protective overcoat layer.

34. The method according to claim 32, wherein:

step (d) comprises forming said DLC protective overcoat layer by ion beam deposition (IBD).

35. The method according to claim 32, wherein:

step (b) comprises forming a layer stack including an outermost granular perpendicular magnetic recording layer.

36. The method according to claim 32, wherein:

step (b) comprises forming a layer stack including an outermost granular longitudinal magnetic recording layer.

37. The method according to claim 1, wherein the nano-scale roughness is less than 2.0 Å.

38. The method according to claim 37, wherein the nano-scale roughness is less than 1.5 Å.

39. The method according to claim 26, wherein the nano-scale roughness is less than 2.0 Å.

40. The method according to claim 39, wherein the nano-scale roughness is less than 1.5 Å.

42. The method according to claim 32, wherein the nano-scale roughness is less than 1.5 Å.

EVIDENCE APPENDIX

Not applicable.

RELATED PROCEEDINGS APPENDIX

Not applicable. Appellant is unaware of any related proceedings.